

BA-4000 Bit Analyzer

100G/400G BIT ERROR RATE (BER) TESTER



BER tester powered up with forward error correction (FEC) margin.

KEY FEATURES

100G (4x28GBd) scalable to 400G (8x56GBd)

Support NRZ and PAM4

Optional multirate PPG from 10 to 28 GBd

Support PRBS 7/9/11/13/15/23/31/13Q/31Q, SSPRQ

FEC simulator

Channel simulator

Burst/random error injection

Support linear/Gray mapping

O-SMPM connection

SPEC SHEET

FEC SIMULATION

The BER tester includes FEC simulation capabilities. This provides powerful analysis of burst error.

Main features include:

- › PRBS error check and correction
- › Pre-FEC and Post-FEC BER
- › KP4/KR4 and low latency FEC protocols
- › FEC lane striping function
- › FEC symbol error distribution plot: codewords vs symbol errors
- › FEC margin auto-calculation

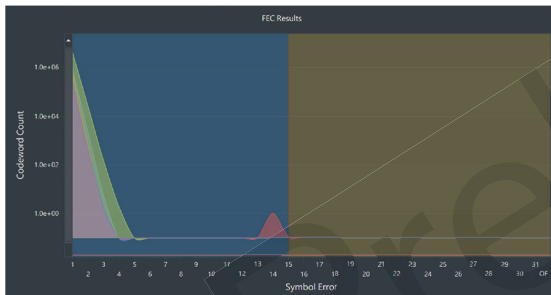
WITH PAM4 CODING, SIMPLE BER TEST IS NOT ENOUGH

Bit Select	Injection Type	Amount	
MSB	Single B/PKT	PKT Gap <input type="text" value="0"/>	Inject Errors
LSB	Burst B/PKT	PKT Count <input type="text" value="1"/>	

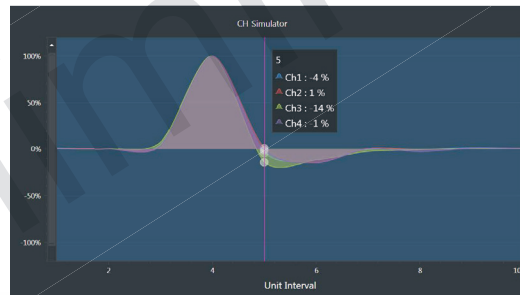
Burst and random error injection

Pre BER	5.003e-08	
Pre Errors	26,581	PN31
Corrected	26,581	PN31
Post BER	0.000e+00	Sync
Margin	87% (max: 2)	KP4
# Bits	531,315,833,984	
Time	10 s	

FEC symbol error margin



FEC symbol error distribution plot



Channel response simulation

All specifications are typical, at 23 °C ± 2 °C unless otherwise specified.

SPECIFICATIONS

Bit Analyzer

Number of channels	4/8 (4 scalable to 8)
Data rate per lane (GBd)	25.78125, 26.5625, 27.95, 28.05, 28.125, 28.9, 49.765, 53.125, 57.8 ^a 9.95328, 10, 10.3125, 10.709, 11.3176, 12.5, 14.025, 21, 24.33024 ^b
Data rate adjustment (ppm)	0 to ±300
Modulation	NRZ/PAM4
PAM4 coding	Linear code/Gray code
Pattern	PRBS 7/9/11/13/15/23/31, PRBS7Q-31Q (PPG and ED) PRBS16, SSPPRQ, user-defined pattern (PPG only)
Maximum Amplitude (mV _{ppd})	800/1000 (typical, without emphasis) 1500 (typical, without emphasis, with HA4/HA8 option)
Rise time/fall time (ps)	11/11 ^{c,d} (20% to 80%, typical) 15/15 ^{e,f} (20% to 80%, typical)
Eye width of PAM4 sub-eyes (ps)	20 ^{c,g} (zero hit, typical) 17 ^{d,h} (zero hit, typical)
Jitter rms (fs)	450 ^{c,d} (typical) 500 ^{e,f} (typical)
Sensitivity (mV _{ppd})	200 to 800 (typical, PAM4 26.5625 GBd, mode depends) 150 to 1000 (typical, NRZ 25.78125 GBd, mode depends)
CTLE (dB)	0 to 8 ⁱ

Clock

Clock output amplitude (mV _{ppd})	400
Clock output ratio	/8, /16, /32, /64

Connectors

Connector type	O-SMPM connector (up to 67 GHz bandwidth)
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GENERAL SPECIFICATIONS

Temperature	Operating Storage	5 °C to 40 °C (41 °F to 104 °F) -20 °C to 70 °C (-4 °F to 158 °F)
Relative humidity		20% to 80%
Power ^j		100/120 Vac (50/60/400 Hz) 220/240 Vac (50/60 Hz) 60 W typical/80 W max.

a. Supported by BA-4000-X-56-PAM4

b. Supported by BA-4000-X-28-NRZ, BA-4000-X-28-SE with option MR4/MR8, and PPG C/D of BA-4000-X-28-PAM with option MR4/MR8

c. Supported by PPG A/B of BA-4000-X-XX-PAM4

d. NRZ 25.78125 GBd signal measured by 50 GHz bandwidth scope with 50 GHz 2.4 mm, 15 cm RF cable

e. Supported by BA-4000-X-28-NRZ, BA-4000-X-28-SE, PPG C/D of BA-4000-X-28-PAM4

f. NRZ 25.78125 GBd signal measured by 50 GHz bandwidth scope with 40 GHz 2.92 mm, 15 cm RF cable

g. PAM4 26.5625 GBd signal measured by 50 GHz bandwidth scope with 50 GHz 2.4 mm, 15 cm RF cable

h. PAM4 26.5625 GBd signal measured by 50 GHz bandwidth scope with 40 GHz 2.92 mm, 15 cm RF cable

i. Supported by ED of BA-4000-X-28-NRZ, BA-4000-X-28-SE, and BA-4000-X-28-PAM4

j. Operate with supply voltage fluctuations up to ±10 % of the nominal voltage

ORDERING INFORMATION

BA-4000-XX-XX-XX

Model ■

- 4-28-NRZ = 4x28 GBd NRZ BERT with O-SMPM (10G~28G)
(not continuous data rate)
- 4-28-PAM = 4x28 GBd PAM4 BERT (support NRZ) with O-SMPM
- 4-56-PAM = 4x56 GBd PAM4 BERT (support NRZ) with O-SMPM
- 8-28-NRZ = 8x28 GBd NRZ BERT with O-SMPM (10G~28G)
(not continuous data rate)
- 8-28-PAM = 8x28 GBd PAM4 BERT (support NRZ) with O-SMPM
- 8-56-PAM = 8x56 GBd PAM4 BERT (support NRZ) with O-SMPM

Options ■

- MR4 = Multi data rate with second PPG 4CH
- MR8 = Multi data rate with second PPG 8CH
- HA4 = High amplitude 1.5Vppd with second PPG 4CH
- HA8 = High amplitude 1.5Vppd with second PPG 8CH
- FEC4 = 26G PAM4 FEC simulator software 4CH^a
- FEC8 = 26G PAM4 FEC simulator software 8CH^b
- FGC4 = FEC pattern generator and checker 4CH^c
- FGC8 = FEC pattern generator and checker 8CH^d

Accessories ■

- ICBOS-KM-7 = 40 GHz, 1x8 O-SMPM to K(male) cable,
7 cm, loss 1.15 dB (max), RL:15 dB (max)
- ICBOS-KM-15 = 40 GHz, 1x8 O-SMPM to K(male) cable,
15 cm, loss 1.4 dB (max), RL:15 dB (max)
- ICBOS-KM-30 = 40 GHz, 1x8 O-SMPM to K(male) cable,
30 cm, loss 2.2 dB (max), RL:15 dB (max)
- ICBOS-KM-60 = 40 GHz, 1x8 O-SMPM to K(male) cable,
60 cm, loss 3.7 dB (max), RL:15 dB (max)
- ICBOS-QM-7 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable,
7 cm, loss 1.2 dB (max), RL:15 dB (max)
- ICBOS-QM-15 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable,
15 cm, loss 1.5 dB (max), RL:15 dB (max)
- ICBOS-QM-30 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable,
30 cm, loss 2.4 dB (max), RL:15 dB (max)
- ICBOS-QM-60 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable,
60 cm, loss 4.2 dB (max), RL:15 dB (max)
- ICBOS-OS-20 = 50 GHz, 1x8 O-SMPM to O-SMPM cable, 20 cm,
loss 2.0 dB (max), RL: 15 dB (max)
- ICBOS-OS-30 = 50 GHz, 1x8 O-SMPM to O-SMPM cable,
30 cm, loss 2.4 dB (max), RL:15 dB (max)
- ICBOS-OS-60 = 50 GHz, 1x8 O-SMPM to O-SMPM cable,
60 cm, loss 4.2 dB (max), RL:15 dB (max)
- ICBOS-SMPM-7 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable,
7 cm, loss 1.2 dB (max), RL: 15 dB (max)
- ICBOS-SMPM-15 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable,
15 cm, loss 1.5 dB (max), RL: 15 dB (max)
- ICBOS-SMPM-30 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable,
30 cm, loss 2.4 dB (max), RL: 15 dB (max)
- ICBOS-SMPM-60 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable,
60 cm, loss 4.2 dB (max), RL: 15 dB (max)

a. Available for BA-4000-4-28-PAM, BA-4000-4-56-PAM and BA-4000-4-28-SE.

b. Available for BA-4000-8-28-PAM, BA-4000-8-56-PAM and BA-4000-8-28-SE.

c. Available for BA-4000-4-56-PAM.

d. Available for BA-4000-8-56-PAM.

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